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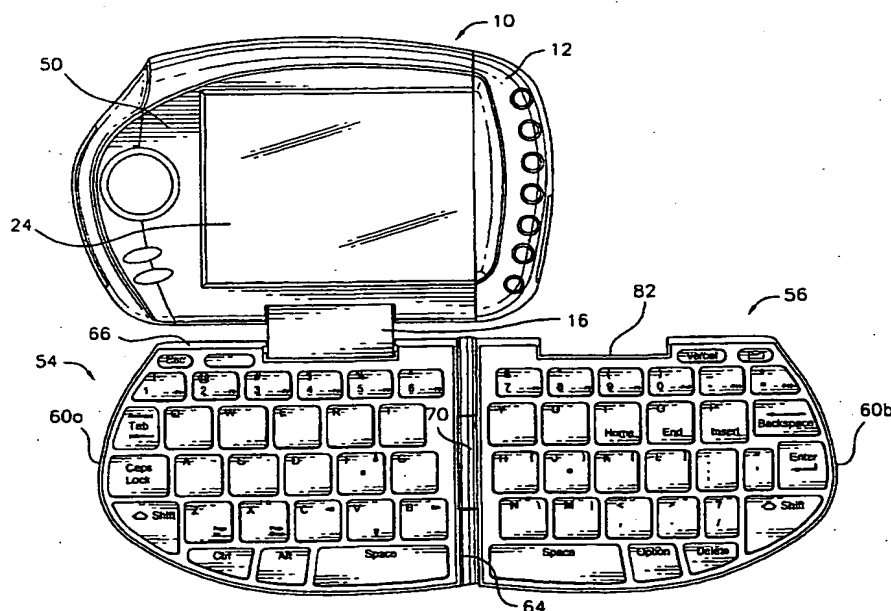
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(54) Title: **HAND HELD INTERNET BROWSER WITH FOLDING KEYBOARD**



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(57) Abstract: The present invention provides an improved hand held computer arrangement wherein data input is facilitated through a full function, folding keyboard, that is suitable for touch typing. In addition, the present invention utilizes an open architecture, embedded technology system design in conjunction with web based content to provide a full function affordable portal to the Internet.



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## 1 HAND HELD INTERNET BROWSER WITH FOLDING KEYBOARD

## FIELD OF THE INVENTION

5 This invention relates generally to portable computers, and more particularly to handheld computers capable of downloading and uploading information from the Internet.

## BACKGROUND

10 The internet has become a pervasive medium through which both commercial and personal users communicate. With the proliferation of use of the Internet, numerous individuals, organizations, and entities have made information available to computer users. In addition, the creation of web browsers makes it easy to exchange information. These browsers provide a user-friendly, point-and-click visual interface to what was once accessible only to the technically proficient. However to further expand the Internet's role as a mass consumer medium, requires ready and inexpensive access to this wealth of information. An Internet for the masses, in their 15 hundreds of millions and ultimately in their billions will transform the Internet beyond just a publishing, entertainment or personal communications medium. Rather the Internet will become a fundamental and indispensable engine driving all social and economic life.

Access to the Internet for the purpose of retrieving or sending information is typically done using a desktop computer.

20 Accessing Internet information using a desktop computer is cost prohibitive for many users. In addition, desktop computer access to the Internet is inefficient because it makes the desired information available to the user only at a relatively permanent, central location. The use of traditional mobile computer systems, such as, for example, laptop and notebook computers, improves the portability of the Internet access device, while maintaining a significant portion of 25 the speed and features provided by desktop computer systems. However, Internet access via a traditional mobile computer for many users is again cost prohibitive.

Similarly, the use of traditional personal digital assistants (PDAs) or wireless communication devices to access the Internet also suffer from numerous disadvantages. For example, commercially available PDAs are relatively costly, with starting prices ranging from 30 several hundred dollars to one thousand dollars and more. Such prices, rival current pricing for desktop systems, and are cost prohibitive for the public at large, and serve to maintain the economic barrier to Internet access.

35 Wireless hand held computer devices, such as cellular and Personal Communication System (PCS) telephones are more reasonably priced, but have limited display and processing capabilities. Prior art wireless computer units typically utilize touch sensitive display screens as the input/output device. These screen are relatively small (1.5-2.5" diameter), and typically have limited function key capability. In addition wireless computer units typically employ wireless application protocol (WAP) that limits Internet browsing. These devices therefore lack the

1 capabilities required to interactively browse the varied text, graphic and video applications available on the Internet.

5 In addition, in many of the portable and stationary applications, it is necessary for the overall size of the keyboards to be reduced when the keyboards and products are stored and transported, especially for portable applications. However, during use, it is desirable for the keyboards to conform to standard sizes to have a typical "feel" for ease and comfort of use. The overall size of the keyboard is particularly critical for text entry via "touch typing."

10 Therefore, it would be advantageous to provide a method and an apparatus for portable computing that is widely affordable and includes sufficient input / output capability.

## SUMMARY OF THE INVENTION

15 There is therefore provided according to a presently preferred embodiment of the present invention, a hand held computer having a full function, ergonomically designed, folding, keyboard that is suitable for touch typing that is also affordable while maintaining a minimal design footprint. The present invention provides a device that permits the inclusion of an ergonomic keyboard fully integrated with a handheld computer. The present invention provides an improved hand held computer arrangement wherein data input is facilitated through a full function, folding keyboard, that is suitable for touch typing. In addition, the present invention utilizes an open architecture, embedded technology system design in conjunction with web based content to provide a full function affordable portal to the Internet.

20 In another aspect of the present invention a hand held personal computer includes a housing having a display mounted in a lower surface of the housing, a folding keyboard, having first and second keyboard sections, that are pivotally coupled to the housing for pivotal movement about a housing axis, wherein the folding keyboard couples to the lower housing surface, substantially covering said display when in a closed position, and a hinge mechanism pivotally coupling the first and second keyboard sections for pivotal movement one relative to the other about a keyboard axis.

25 In a further aspect of the present invention a hand held web browser includes an embedded computer comprising a microprocessor, and a data storage device coupled to the microprocessor for storing a real-time operating system and a thin Internet browser for execution by the microprocessor, a housing having a display mounted in a lower surface of the housing, wherein said microprocessor is coupled to the display, a folding keyboard, having first and second keyboard sections, pivotally coupled to the housing for pivotal movement about a housing axis, wherein the folding keyboard couples to the lower housing surface, substantially overlaying the display when in a closed position, and a hinge mechanism pivotally coupling said first and second keyboard sections for pivotal movement one relative to the other about a keyboard axis.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. 1 is a front view of a hand held computer with a full function folding keyboard in accordance with an exemplary embodiment of the present invention;

FIG. 2 is a simplified block diagram of the computer components of the hand held computer in accordance with an exemplary embodiment of the present invention;

FIG. 3 is a graphical illustration of the physical interface between a plurality of I/O ports and the motherboard in accordance with an exemplary embodiment of the present invention;

FIG. 4 is a front rear and side view of the hand held computer illustrating the integration of a plurality of I/O ports in the display housing in accordance with an exemplary embodiment of the present invention;

FIG. 5 is a perspective view of the hand held personal computer with the folding keyboard in the open or operation position in accordance with an exemplary embodiment of the present invention;

FIG. 6 is a perspective view of the hand held personal computer with the folding keyboard in the folded position in accordance with an exemplary embodiment of the present invention;

FIG. 7 is a perspective view of the hand held personal computer with the folding keyboard coupled to the display housing in the closed position in accordance with an exemplary embodiment of the present invention;

FIG. 8 is a perspective view of the hand held personal computer with the folding keyboard rotated behind the display housing in accordance with an exemplary embodiment of the present invention;

FIG. 9 is a planview of keypad plate demonstrating the functionality of the folding keyboard in accordance with an exemplary embodiment of the present invention;

FIGS. 10a and 10b are exploded views of low profile finger pads in accordance with an exemplary embodiment of the present invention;

FIG. 10c is a cross-section of a low profile finger pad having a rigid support member in accordance with an exemplary embodiment of the present invention;

FIG. 11A is an exploded view of the hand held computer illustrating the assembly of the display housing and folding keyboard in accordance with an exemplary embodiment of the present invention;

FIG. 11B is a prospective view of flex ribbon protective sleeves and the flex ribbon that connects the keyboard halves with the keyboard in the open position, in accordance with an exemplary embodiment of the present invention;

FIG. 11C is a prospective view of flex ribbon protective sleeves and the flex ribbon that connects the keyboard halves with the keyboard in the closed position in accordance with an

1 exemplary embodiment of the present invention;

FIGS. 12a-c are side views illustrating the operation of a support member for varying the angle of the display housing in accordance with an exemplary embodiment of the present invention;

5 FIG. 13 is a perspective view of the hand held computer demonstrating the integration of the support member into an upper surface of the display housing in accordance with an exemplary embodiment of the present invention; and

FIG. 14 is a perspective view of the hand held computer with the support member in the closed position in accordance with an exemplary embodiment of the present invention.

## 10 DETAILED DESCRIPTION OF THE INVENTION

An exemplary embodiment of the present invention provides a method and apparatus for accessing and downloading information from the Internet to a hand held computer system. In a preferred embodiment the hand held computer system, uses flash memory storage, to store an operating system, Internet application software, display application software, and search criteria. The hand held computer downloads information from the Internet to the flash memory for subsequent display of the information via an integrated VGA grayscale or color display. The hand held computer system includes a phone jack through which the Internet is accessed via an internal modem. In addition, the hand held computer includes Internet phone capability (which provides long distance calls at local rates) with Internet messaging as well as wireless Internet browsing.

Commercially available PDA systems typically utilize expensive, memory intensive application software and Operating Systems (OS) in a closed system architecture. Existing systems are prohibitively costly for a large segment of the population because of this reliance upon internal software for scheduling, word processing, browsing the web etc. Advantageously, the present invention utilizes a less costly OS in an open architecture, embedded computer design approach. The present invention leverages web based systems such as for example, Yahoo's calendar, e-mail, address book etc., to provide full function capability at a fraction of the price of existing portable computing devices. An embedded computer is a microprocessor, and a real-time operating system and application software that has been built into a larger product to handle the control functions of that product.

Unlike multipurpose PC operating systems such as Windows, that must take into account every conceivable user input and support a large variety of applications, an embedded system typically need only support a narrow suite of functions. Thus, in an exemplary embodiment of the present invention the operating system may be tailored to perform web based applications.

An advantage of embedded systems is that, partly because they are dedicated to the performance of a single task or specific group of tasks, they can be optimized to deliver a level of speed, reliability, and low cost that PC hardware and software manufacturers can not obtain.

1 As a result, embedded systems have far smaller memory requirements. This enables embedded systems to offer a far more economical approach to building relatively less expensive, Internet-browsing appliances than traditional prior art PC approaches, such as Oracle with its stripped-down network computer.

5 In an exemplary embodiment, the present invention may utilize Spyglass® Device Mosaic, or other similar thin browsers optimized to run on one of the many leading real time operating systems used in the embedded market such as OS9, VxWorks, pSOS, LynxOS, etc. Advantageously thin browsers typically occupy less than 850kB of code, while fully supporting the latest Internet standard technologies, such as HTML, HTTP, JScript and SSL. In addition  
10 such thin browsers can be extended to include features such as Java and XML.

Also the modular design of typical thin browsers make them scalable across a wide range of devices. Thus the embedded technology, web based approach of the present invention readily adapts to a variety of applications such as for example, educational applications such as audio enhanced hooked on phonics, study guides etc., as well as child development applications such  
15 as downloaded interactive E-books. Similarly the present invention can interface with a variety of web based publications through E-subscriptions which are downloaded directly from a web site, or research oriented how to guides such as automotive repair magazines, maps etc.

Also, because the embedded technology approach optimizes a given system for a particular application, hardware locked safe browser can be readily included in a particular embodiment.  
20 In addition, a favorite places directory may also be include in a given embodiment, wherein a user can speed dial a given Internet address with a single keystroke.

FIG. 1 shows a front view of a hand held computer 10 according to the present invention. The hand held computer 10 of this invention has a clamshell design having a display housing 12 and keyboard 14 joined for pivotal movement thereof one relative to the other about an elongated  
25 housing axis and between a folded position (FIG. 6) and a use position (Figure 5). The hinge structure 16 may be any suitable hinge appropriate to the usage expected of the hand held computer 10, such as a hinge molded of synthetic materials, or other hinges known to persons skilled in the applicable arts of mechanical and aesthetic design.

Computer operating components for performing the desired computer functions are  
30 mounted in the display housing 12. At least certain of these components are mounted on a multi-layer motherboard (not shown) that is mounted in the display housing and electrically interconnects components of the hand held computer 10.

FIG. 2 is a simplified block diagram of an exemplary hand held computer 10 and illustrates the various components of the computer 10, including components mounted on the  
35 motherboard as well as other hardware of the hand held computer system. A microprocessor acts as the CPU 18 of the hand held computer 10. The CPU support circuitry preferably includes a data storage device (not shown) that may be a nonvolatile device in the range of about ten to one hundred megabytes, wherein both control routines for applications and data files are stored in the

1 data storage device. The data storage device may be flash memory, CMOS ROM, CMOS RAM  
with battery, or a combination thereof. The data storage device interfaces with the CPU 18 via  
a dedicated high speed local bus structure through a bus timing controller. In the described  
exemplary embodiment, CPU 18 is configured to drive the dedicated bus.

5 In the preferred embodiment, battery(s) 20 supplies power to hand held computer 10, and  
may be recharged in one or more of several ways through power interface port 22. The internal  
power traces are not shown in FIG. 2, but extend to all of the powered devices in the hand held  
computer 10.

10 In a preferred embodiment, a VGA display 24, typically a 320x240 grayscale or color  
screen acts as an I/O interface. The display screen may also include touch screen capability, so  
that a user may enter commands directly from the display screen. The size and location of VGA  
display 24 may vary, but in general occupies a major portion of one of the sides of the display  
housing. In addition, an exemplary hand held computer includes a full functioning compact  
keyboard 20 with complete alphanumeric capability.

15 The described exemplary hand held computer may include an expansion interface 26 that  
functions as an expansion port. The purpose of the optional expansion interface 26 is to connect  
to optional peripheral devices, such as a local area network, an ethernet connection, a host  
cellular phone, two way pager and others. The expansion interface 26 is not an essential feature  
in a minimum embodiment of the present invention, but provides enhanced functionality in many  
20 embodiments. Preferably, expansion interface 26 includes an extended enhanced parallel port  
and communication protocol that is compatible with typical expansion devices, such as telephone  
modems, fax modems, scanners, and the like. Many other configurations are possible.

25 In an exemplary embodiment the expansion interface 26 comprises a compact flash  
connector that couples compact flash modules inserted into a compact flash socket to an  
expansion bus coupled to CPU 18. As is known in the art, compact flash modules are small,  
removable mass storage devices. Compact flash products are solid state, containing no moving  
parts, and provide users with greater protection of their data than conventional magnetic disk  
drives. In operation, when a compact flash module is inserted into the hand held computer the  
hand held computer identifies the function of the module. The hand held computer may then  
30 display an icon and configuration support information for the inserted module on the display  
panel.

35 The compact flash module preferably uses system drivers and resources from the BIOS  
of the hand held computer. The compact flash module will provide the core software that is  
required for that function. The compact flash socket is not just designed for memory storage.  
Rather the compact flash socket may can be used as an expansion port for a number of hardware  
add-ons that range from digital cameras or video recorders to hardware that receives satellite  
global positioning information to display an exact position on a map on the display 24.

Further, the hand held computer may interface with commercially available digital



1 compact flash phone cards. The digital phone cards interface directly with digital phones to  
provide wireless Internet connectivity. In operation, a wireless or cellular uplink connection  
between a user and Internet access provider may be established when a user transmits Internet  
access commands over its associated antenna in a predetermined data format, e.g., the well-  
5 known Cellular Digital Packet Data (CDPD) format.

A base station serving the coverage area in which the user is located receives the data via  
its associated antenna. The base station then sends the data to a conventional mobile telephone  
switch office (MTSO) for presentation to an Internet access provider (hereinafter also IAP). The  
IAP then reformats the data (command/request) for transmission to the identified web/host site  
10 over Internet. The IAP also transports responses received from the host site/Internet to the  
cellular base station via the MTSO. The cellular base station in turn, reformats the data into a  
form expected by the user unit identified in the response received, and transmits the reformatted  
data over its associated antenna.

In addition, one or more companies have recently developed software for use on portable  
15 computers that permits two-way transfer of real-time voice information between two personal  
computers via an Internet data link. A user of the hand held personal computer may utilize a  
compact flash socket to invoke a voice data interface mode. In voice data mode, voice signals,  
or other audio sounds, are received by a microphone that is coupled to the hand held personal  
computer. The software on the hand held computer then converts voice signals from analog to  
20 digital format. The software facilitates data compression down to a rate compatible with modem  
communication via a POTS telephone line. The software also facilitates encapsulation of the  
digitized and compressed voice data into the TCP/IP protocol, with appropriate addressing to  
permit communication via the Internet. At the receiving end, the computer and software reverse  
the process to recover the analog voice information for presentation to the other party. Such  
25 programs permit telephone-like communication between Internet users registered with Internet  
Phone Servers.

The preferred embodiment of hand held computer 10 includes an integrated internal  
modem 28. Modem 28 is connected to CPU 18 via a dedicated communication bus. Industry  
accepted communication protocol may be used to drive internal modem 28. An industry standard  
30 RJ11 jack 30 interfaces the internal modem with external phone lines. An exemplary  
embodiment of the hand held computer includes a plurality of I/O ports. The real time operating  
system utilizes an I/O manager and file manager to support the input/output (I/O) features. File  
managers are hardware-independent modules designed to handle I/O processing for a specific  
class of devices. Device drivers handle the basic physical I/O functions for specific controllers.  
35 The device descriptors are small, non-executable modules that associate a specific I/O device  
with a logical name, hardware address, device driver name, and initialization parameters.

The file managers provide an abstraction layer between the application and the physical  
hardware and provide logical I/O support such as opening, reading, or writing for a device.

1 Device drivers handle physical I/O such as initializing the device and reading or writing a standard physical unit of data from the device. In addition as new I/O devices are added to the hand held computer, a user may utilize the existing file managers for the logical I/O support and easily develop the code to handle the physical I/O device.

5 For example, an exemplary embodiment of the present invention may include MP3 software loaded on the data storage device or a compact flash socket to support stereo audio. The MP3 software provides the capability to download, store and play digitized MP3 music files. The described exemplary hand held computer may download digitized music files from the Internet or from another hand held computer or computing device. The hand held computer may store  
10 digitized music files a compact flash memory module or locally in memory. The operating system therefore, preferably includes a software driver that drives a stereo driver circuit 32 that provides I/O support for external stereo headsets (not shown) via stereo jack 34.

Further, an exemplary embodiment of the hand held personal computer includes a mono speaker driver circuit 36 and a microphone / amplifier driver circuit 40 that drive a mono-speaker  
15 and microphone jack 38 respectively. The mono-speaker and microphone jack 38 may be used for example to provide IP phone capability as previously discussed. Similarly, an exemplary hand held personal computer may include USB A 42 and USB B 46 drivers and interface ports 44 and 48 respectively to interface with a plurality of host / receiver peripherals as is known in the art. In addition, a IR transceiver 52 may be included in an exemplary hand held computer.  
20 The IR transceiver may be used to communicate with other hand held computers as well as other peripherals such as for example printers, scanners etc.

FIG. 3 graphically illustrates the physical interface between the various I/O ports and the motherboard 50. As previously described, an exemplary hand held computer may include a power interface port 22 for recharging the internal power batteries, as well as a mono-speaker /  
25 microphone port 38 and stereo port 34 for external audio input and output. A hand held computer may also include an IR transceiver 52 in accordance with industry standards for communicating with other hand held computers or with other external peripherals. The CF socket 24 houses the compact flash modules and the RJ11 jack 30 provides a standardized interface between the internal cable modem with external phone lines. Similarly, the USB A port  
30 44 provides a standardized interface to host computers and other standard peripherals and the USB B port 48 provides a receiver interface to compatible devices such as digital cameras or other peripherals. The top, rear, left side and right side views of FIG. 4 illustrate the integration of the various I/O ports in the display housing 12.

Referring back to FIG. 1 a front surface 50 of the display housing comprises, in  
35 substantial part, a display screen 24 for displaying stored or downloaded information. The display screen 24 may provide touch screen capability, so that a user may enter commands directly from the display screen. In these touch-screen embodiments, an invisible touch panel or membrane may be set over the display apparatus. In one embodiment the touch screen may

1 be of the voltage-divider type that detects a contacting position in a touch panel sensor as is  
known in the art. Voltage divider touch screens comprise a pair of substrates (an "X substrate"  
and a "Y substrate") spaced from each other by a gap, and on each of which a layer or region of  
5 resistive material is provided. A pair of lines formed of conductive material are provided at  
opposed edges of each of the resistance layers. The resistance layers face each other in  
overlapping relationship with the conduction lines of one substrate extending in a generally  
perpendicular direction to the conduction lines of the other substrate. Digital to Analog (D/A)  
circuitry is provided by which voltage is applied and switched between the respective substrates  
10 through their respective conduction lines so that one substrate (active) is coupled between five  
volts and ground and the other is unconnected (inactive).

Therefore, when the touch panel is depressed at a point in its active area, the resistance  
layers flex into engagement at a particular point, and a voltage indicative of the Y coordinate is  
read from the X substrate utilizing Analog to Digital circuitry. Then the applied voltage is  
switched from the Y substrate to the X substrate, and a voltage indicative of the X coordinate is  
15 read from the Y substrate in the same manner. When voltage is applied to a given substrate, the  
resistive layer on the substrate acts as a voltage divider, and the other substrate acts like a wiper  
arm of a potentiometer such that the coordinate position of the contacting point can be detected.

In the touch screen embodiments, the hand held computer displays icons, characters, etc.,  
on the display screen. When an operator touches the icons or characters, displayed on the display  
20 screen, a touch point is detected and the operator's input is determined. In addition the front  
surface 50 of the display panel may have any number of control buttons for controlling the  
display and or for interfacing with the hand held computer.

In an exemplary embodiment keyboard 14 is preferably foldable. The foldable keyboard  
14 has two substantially planar keyboard halves 54 and 56. Each of the keyboard halves  
25 comprise a rubberized keypad 58a and 58b and circuit board (not shown) supported by keyplates  
60a and 60b having bottom plates with front, side and rear walls 62, 64, and 66, respectively.  
The keyboard sections 54 and 56 are coupled to one another by an intermediate hinge 70 such  
that when the keyboard is in the open position as shown in FIG. 5, the first keyboard half 54 is  
substantially coplanar with the second keyboard section 56. In addition, the right-hand keyboard  
30 half 56 includes a notch 82 to accommodate the hinge mechanism 16 that couples the display  
housing 12 and the keyboard 14 when the keyboard is in the folded position.

In addition, the keyboard halves are of similar widths so that when keyboard section 56  
is pivoted about the pivotal axis into its folded position, it substantially overlays and is coincident  
with keyboard section 54 (see FIG. 6). It is readily apparent that other embodiments of this  
35 folding keyboard may have larger size keyboards or smaller size keyboards for alternate size  
devices.

Referring to FIG. 7, the keyboard 14 may be folded and the display panel housing 12 may  
then be folded over the keyboard 12 into the closed position. Referring back to FIG. 6, in one

1 embodiment the front face of the display housing 12 may include a recess 60 that engages the  
folded keyboard 14 such that the folded keyboard forms a protective cover over the display panel  
24. Further, the front surface 50 of the display housing 12 may also include control buttons 64  
for an MP3 player that may be accessed when the keyboard is in the closed position. In the  
5 described exemplary embodiment the hand held computer preferably includes play 64a, pause  
64b, reverse 64c and forward 64d, MP3 controls. A user therefore has full functional control  
over the MP3 player, allowing the user to play music when the keyboard is in the closed position,  
protecting the display.

Further, referring to FIG. 8, the keyboard 14 may be folded completely behind the display  
10 housing 12. The hand held computer may then be controlled with the touch screen display panel  
24 and front panel controls. For example, in one embodiment a cursor control 52a may be  
included to allow user input when the keyboard is in the folded position. In addition, mode 52b  
and select 52c controls may also be included on the front surface 50 of the display housing 12.  
In addition, when in game mode MP3 controls 64 located on the front surface of the display  
15 housing may be converted to firing and game control buttons for interfacing with computer  
games. One of skill in the art will appreciate that alternate controls may be readily integrated into  
the display so that the described control features are by way of example only and not limitation.

Referring to the planview of an exemplary keypad plate illustrated in FIG. 9, each keypad  
section 58a and 58b has a plurality of depressable keys 80 arranged on a surface. Each of the  
20 keys 80 is substantially the same size as keys found on a standard keyboard. In an exemplary  
embodiment the keys are located in the "QWERTY" format found on most computers and  
typewriters, wherein keys in one row are staggered relative to the keys in an adjoining row.  
Therefore the adjoining key boundaries (e.g. "T" and "Y" keys) of the planar keypad sections 58a  
and 58b present a broken pattern of adjacent keys when the keyboard is unfolded so that the  
25 adjacent halves of the keyboards form substantially straight lines.

In addition, an exemplary keyboard may include an option function 84 to provide function  
key and other specialty key capability such as for example control arrows, page up or down, etc.  
One of skill in the art will appreciate that the keyboard of the present invention is equally usable  
with keyboards having other formats. Therefore, the described exemplary keyboard format is by  
30 way of example and not by way of limitation.

The described exemplary keyboard 14 is a relatively thin, light weight keyboard. In the  
past tradeoffs have often been made between the "touch typing quality" of a keyboard and the  
acceptable thickness of the keyboard. Historically, making keyboards thinner often required  
reducing the depth of the keystroke. A keystroke of approximately three millimeters is typically  
35 favored by most users, particularly touch typists, because it is similar in feel to a desktop  
computer keyboard. The described exemplary keyboard maintains the feel and key travel of  
desktop computer keyboard.

Historically keycaps have typically included retainers to engage a front plate of a

1 keyboard. Conventionally, each key is normally held in a raised position above the keyboard-  
base by a biasing device with an electrical switch connected between the keyboard-base and each  
key. In operation when a conventional key was depressed, contacts on a flexible dome make  
5 contact with electrical traces on a circuit board. This design suffers from the additional weight  
needed for the front plate and the thickness of the key includes space for the key travel both  
above and below the front plate. Therefore it would be difficult to make a key having a travel of  
three millimeters less than about nine millimeters thick using this type of key design.

Referring to the exploded view of FIG. 10A, the described exemplary keyboard utilizes  
low profile, flexible buttons and back supports to overcome these deficiencies and provide the  
10 user with an improved touch typing quality. FIG. 10A illustrates a cross section of a key 90  
formed from a molded layer of flexible material 92, such as polyurethane, that is bonded to a  
circuit board. The flexible layer may have dome shaped finger pads 94 for keys, and the flexible  
circuit board (not shown) has electrically conductive traces 96 forming circuitry for  
communicating keystrokes to a control circuit module located in the keyboard or on the mother  
15 board within the display housing. The lower surface of finger pad 94 includes a conductive  
contact 100 that forms a contact closure element. The key profile may be further reduced, and  
or the key travel further increased, by replacing the flexible dome as illustrated in FIG. 10A with  
a conductive coating 102 (such as for example carbon paint) on the underside of the reduced  
profile finger pad 98 as shown in FIG. 10B. The contact closure element selectively provides  
20 electrical contact with traces 96 on the circuit board when a user presses the finger pad 94.  
Contact closure causes a signal to be transmitted to a control circuit module to be coded for  
transmission to the computer's processor. The regions of conductive material that form contact  
closure element 102 on the underside of the finger pads may be formed in accordance with any  
of a number of different ways known to those of skill in the art. For example, the conductive  
25 regions may be provided by a conductive, rubber-based coating applied in a conventional manner,  
such as by silk-screening, or other masking techniques.

Referring to the cross-section of FIG. 10c in the described exemplary embodiment, a  
structural rib 104 may be included around at least a portion of each key. The rib 104 is rigid to  
provide a firm offset of the key top from the circuit board for increased key travel. The rib also  
30 acts to stiffen the assembly when bonded to the circuit board. Although one type of key is  
illustrated and described, other types of keys, such as dome switches or membrane keys, with or  
without rigid keycaps, can also be used alone or in combination as needed or desired.

Referring to the exploded view of FIG. 11, collectively the rubberized keypad and circuit  
board 200 are coupled to each of the keyboard plates 54 and 56, so that the two circuit board  
35 halves are flat, and registered with the keys of their respective section. The keyboard plates 60a  
and 60b are pivotally coupled by a hinge mechanism 70 along the centerline of the keyboard  
plates. Keyboard plate 60a may include semicircular surfaces 202 and 204 extending over the  
side wall 64 along the centerline of the keyboard plate. The semicircular surfaces 202a and 202b

1 preferably include end caps 206 having hinge pins 208 which in part form a pivot axis about  
which the keyboard halves pivot. In the described exemplary embodiment there are notches 210  
formed between the centerline sidewall 64 of keyboard plate 60a and the semicircular surfaces  
202a, 202b that provide clearance for collars 212a, 212b formed on the centerline of keyboard  
5 plate 60b. The collars 212a, 212b couple to the hinge pins 68 forming a hinge mechanism that  
allows keyboard plate 60b to rotate relative to keyboard 60a.

The circuit boards for each keyboard half are preferably electrically coupled by a flex  
ribbon 214. The centerline sidewalls of keyplates 60a and 60b preferably include notches that  
receive the flex ribbon 214. When the keyboard sections are in the open, unfolded position, the  
10 flexible ribbon 214 is straightened into a flat, planar shape. However, when in the closed or  
folded position the flexible ribbon 214 is curved in the perpendicular, cylindrical direction  
between the sections.

The flex ribbon 214 is susceptible to mechanical damage. Therefore, the described  
exemplary keyboard preferably includes a protector comprising top and bottom flex ribbon  
15 sleeves 216 and 218. The flex ribbon sleeves insulate the flex ribbon from mechanical damage  
and allow the ribbon to flex freely during opening and closing. The flex ribbon sleeves may be  
molded, with an arch, from a suitable synthetic material, such as a highly elastic soft shore PVC,  
for flexing in both the x axis and y axis. Therefore, when the keyboard is in the open position  
(see FIG. 11B) the tension in the flexible ribbon straightens the flex ribbon sleeves into a  
20 relatively flat, planar shape. When the keyboard is closed, however, the flex ribbon sleeves retain  
the molded arch (see FIG. 11C).

In an exemplary embodiment, the ribbon sleeves float freely and are not anchored to the  
keyboard. One of the flex ribbon sleeves, for example the lower sleeve 218, includes pins and  
the other flex ribbon sleeve, for example the upper sleeve 216, includes apertures that receive the  
25 pins of the opposite sleeve to couple the two sleeves together, thereby enclosing a portion of the  
flex ribbon. Alternatively, a one piece ribbon sleeve with a live hinge that snaps together on one  
end may also be used.

In the described exemplary embodiment, a second flex ribbon 230 electrically couples the  
keyboard to the computer electronics, located in the display housing. Upper and lower hinge  
30 parts 232 and 234, preferably include opposing pins and recesses that couple the hinge parts to  
each other. The hinge parts enclose the second flexible ribbon 230, and include semi-circular  
236a and 236b apertures that couple to hinge pins 238a and 238b formed in a notch 240 at the  
rear of keyboard plate 54. The hinge parts 232 and 234 further include semi-circular recesses  
242a and 242b that couple to hinge pins 244a and 244b located within a notch formed in the  
35 lower enclosure 246 of the display housing. The top enclosure 248 of the display housing  
includes a notch 250 that provides clearance for the upper hinge part 232 when the keyboard is  
in the folded and closed position.

Referring to FIGS. 12a-c, the described exemplary handheld computer preferably includes

1 a support member 300 pivotally hinged to a lower surface 302 of the lower enclosure 246 of the  
display housing. The support member 300 allows the hand held personal computer to be used  
on a table top. The support member 300 preferably positions the display panel at a plurality of  
5 viewing angles (see FIGS. 12a, 12b, and 12c) to accommodate the height of the user and local  
lighting conditions. Referring to FIG. 13 the lower surface 302 of the display panel housing  
preferably includes recesses 304 that engage the support stand when rotated into a retracted  
position as shown in FIG. 14. The support member preferably includes hinge pins having flat  
areas that couple to ribs within the upper surface of the display housing.

10 Although a preferred embodiment of the present invention has been described, it should  
not be construed to limit the scope of the present invention. Those skilled in the art will  
understand that various modifications may be made to the described embodiment. For example,  
the present invention is readily performs as an E-Book reader, capable of downloading and  
displaying all digital texts from any library worldwide. Similarly, the present invention may also  
15 include stereo audio with the capability to download record and play MP3 music files. Moreover,  
to those skilled in the various arts, the invention itself herein will suggest solutions to other tasks  
and adaptations for other applications. It is applicant's intention to cover by claims all such uses  
of the invention and those changes and modifications that could be made to the embodiments of  
the invention herein chosen for the purpose of disclosure without departing from the spirit and  
scope of the invention.

## 1 CLAIMS:

1. A hand held computer, comprising:  
a housing having a display mounted in a lower surface of said housing;  
a folding keyboard, comprising first and second keyboard sections, pivotally coupled to  
5 said housing for pivotal movement about a housing axis, wherein said folding keyboard couples  
to said lower housing surface, substantially covering said display when in a closed position; and  
a hinge mechanism pivotally coupling said first and second keyboard sections for pivotal  
movement one relative to the other about a keyboard axis.

10 2. The hand held computer of claim 1 further comprising an embedded processor  
mounted in said housing for processing information, wherein said processor is electrically  
coupled to said keyboard and said display.

15 3. The hand held computer of claim 2 further comprising a data storage device  
coupled to said embedded processor, wherein said data storage device stores both control routines  
for applications and data files.

20 4. The hand held computer of claims 3 wherein said data storage device stores a real  
time operating system for execution by said embedded processor.

5. The hand held computer of claims 3 wherein said data storage device stores a thin  
Internet browser for accessing the Internet real time operating system for execution by said  
embedded processor.

25 6. The hand held computer of claim 2 further comprising an expansion port coupled  
to said processor.

7. The hand held computer of claim 6 wherein said expansion port comprises a  
compact flash socket and compact flash interface.

30 8. The hand held computer of claim 7 further comprising one or more MP3 controls  
mounted to the lower surface of said housing, wherein said MP3 controls are accessible when  
said folding keyboard is coupled to said housing.

35 9. The hand held computer of claim 8 wherein said hand held computer provides  
video game capability via said compact flash interface and wherein said MP3 controls may be  
reprogrammed to provide video game control functions.



1           10.    The hand held computer of claim 7 further comprising a mono-speaker and  
microphone for use as an Internet phone.

5           11.    The hand held computer of claim 7 further comprising a digital phone card coupled  
to said compact flash interface and a cellular phone. for wireless Internet access.

          12.    The hand held computer of claim 1 further comprising one or more universal serial  
bus connectors coupled to said processor.

10          13.    The hand held computer of claim 1 wherein a first flex ribbon electrically couples  
said first and second keyboard sections.

15          14.    The hand held computer of claim 13 further comprising two or more flex ribbon  
sleeves that enclose at least a portion of said first flex ribbon to protect it from mechanical  
damage.

          15.    The hand held computer of claim 2 wherein a second flex ribbon electrically  
couples said folding keyboard and said processor.

20          16.    The hand held computer of claim 1 wherein said folding keyboard comprises a  
plurality of low profile depressable keys.

25          17.    The hand held computer of claim 16 wherein each of said plurality of low profile  
depressable keys comprise a molded layer of flexible material forming a finger pad and a contact  
closure element for contacting electrically conductive traces on a circuit board.

          18.    The hand held computer of claim 17 wherein contact closure element comprises  
a conductive coating on an underside of said finger pad.

30          19.    The hand held computer of claim 18 wherein said conductive coating is a carbon  
ink.

          20.    The hand held computer of claim 1 wherein said display comprises a touch screen.

35          21.    The hand held computer of claim 1 further comprising one or more display controls  
mounted to the lower surface of said housing.

          22.    The hand held computer of claim 21 wherein said display controls comprise a

1 cursor control.

23. The hand held computer of claim 2 further comprising an internal modem coupled  
to said processor and an external data port for communication over a telephone line.

24. A hand held Internet browser, comprising:  
an embedded computer comprising a microprocessor, and a data storage device coupled  
to said microprocessor for storing a real-time operating system and a thin Internet browser for  
execution by the microprocessor;

a housing having a display mounted in a lower surface of said housing, wherein said  
microprocessor is coupled to said display;

a folding keyboard, comprising first and second keyboard sections, pivotally coupled to  
said housing for pivotal movement about a housing axis, wherein said folding keyboard couples  
to said lower housing surface, substantially overlaying said display when in a closed position; and

a hinge mechanism pivotally coupling said first and second keyboard sections for pivotal  
movement one relative to the other about a keyboard axis.

25. The hand held Internet browser of claim 24 further comprising an expansion port  
coupled to said processor.

26. The hand held Internet browser of claim 25 wherein said expansion port comprises  
a compact flash socket and compact flash interface.

27. The hand held Internet browser of claim 26 further comprising a mono-speaker and  
microphone for use as an Internet phone.

28. The hand held Internet browser of claim 26 further comprising a digital phone card  
coupled to said compact flash interface for wireless Internet access.

29. The hand held Internet browser of claim 24 further comprising one or more  
universal serial bus connectors coupled to said processor.

30. The hand held Internet browser of claim 24 further comprising an internal modem  
coupled to said processor and an external data port for communication over a telephone line.

31. The hand held Internet browser of claim 24 wherein a flex ribbon electrically  
couples said first and second keyboard sections.

1           32.    The hand held Internet browser of claim 24 further comprising two or more flex  
ribbon sleeves that enclose at least a portion of said flex ribbon to protect it from mechanical  
damage.

5           33.    The hand held Internet browser of claim 32 wherein said flex ribbon sleeves are  
preferably formed from soft shore PVC to flex in both x axis and y axis.

10

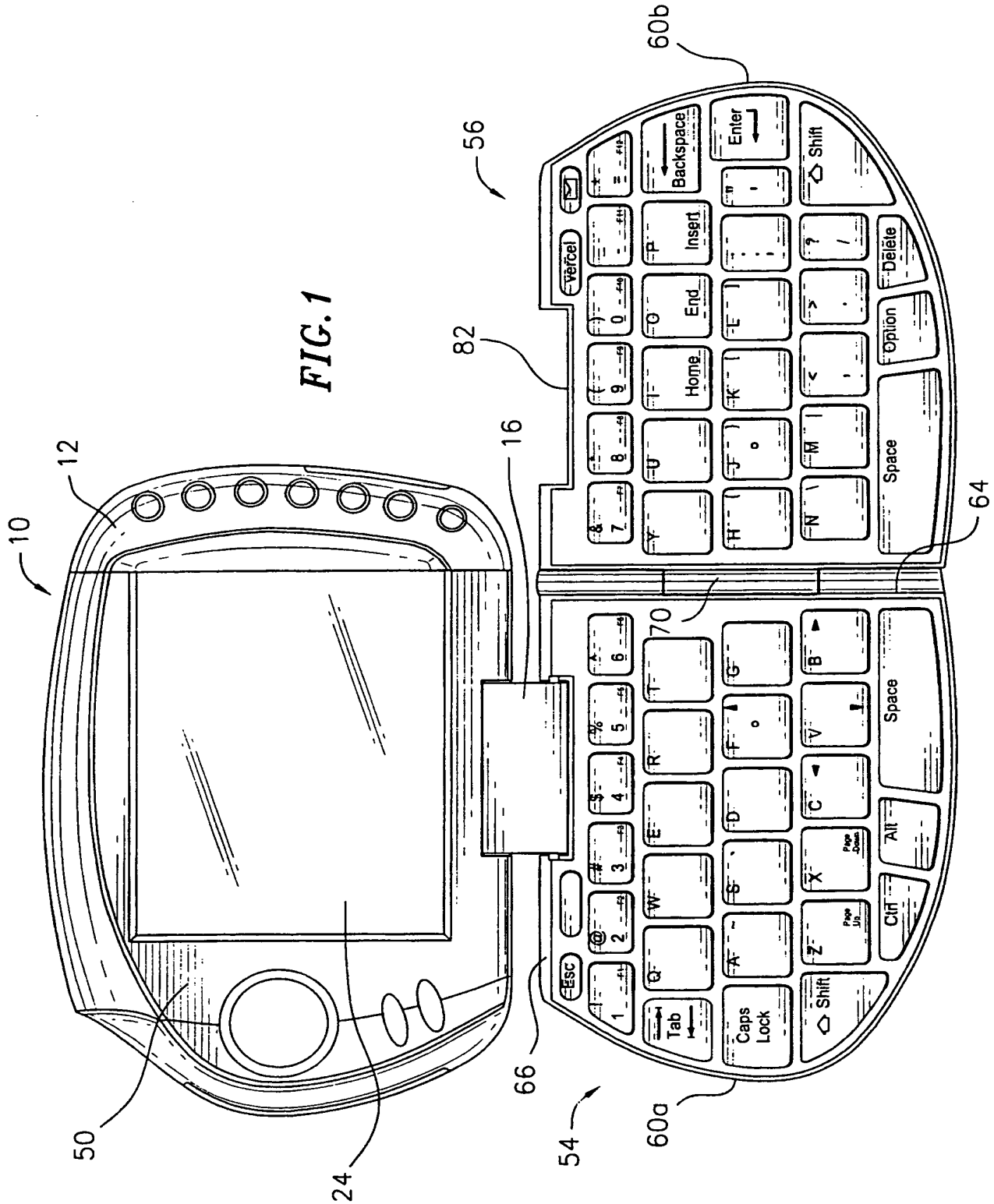
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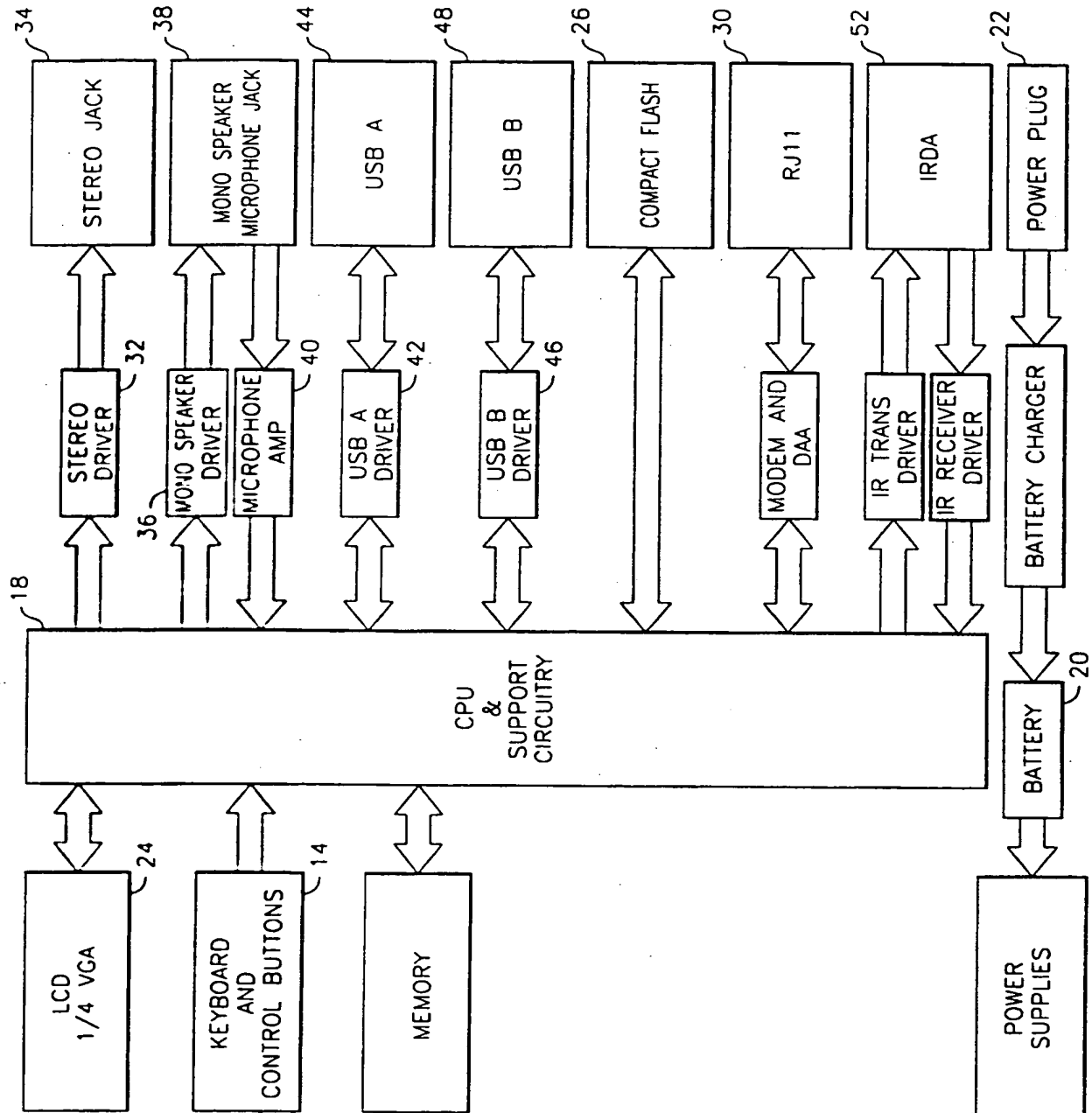


FIG. 2

FIG. 3

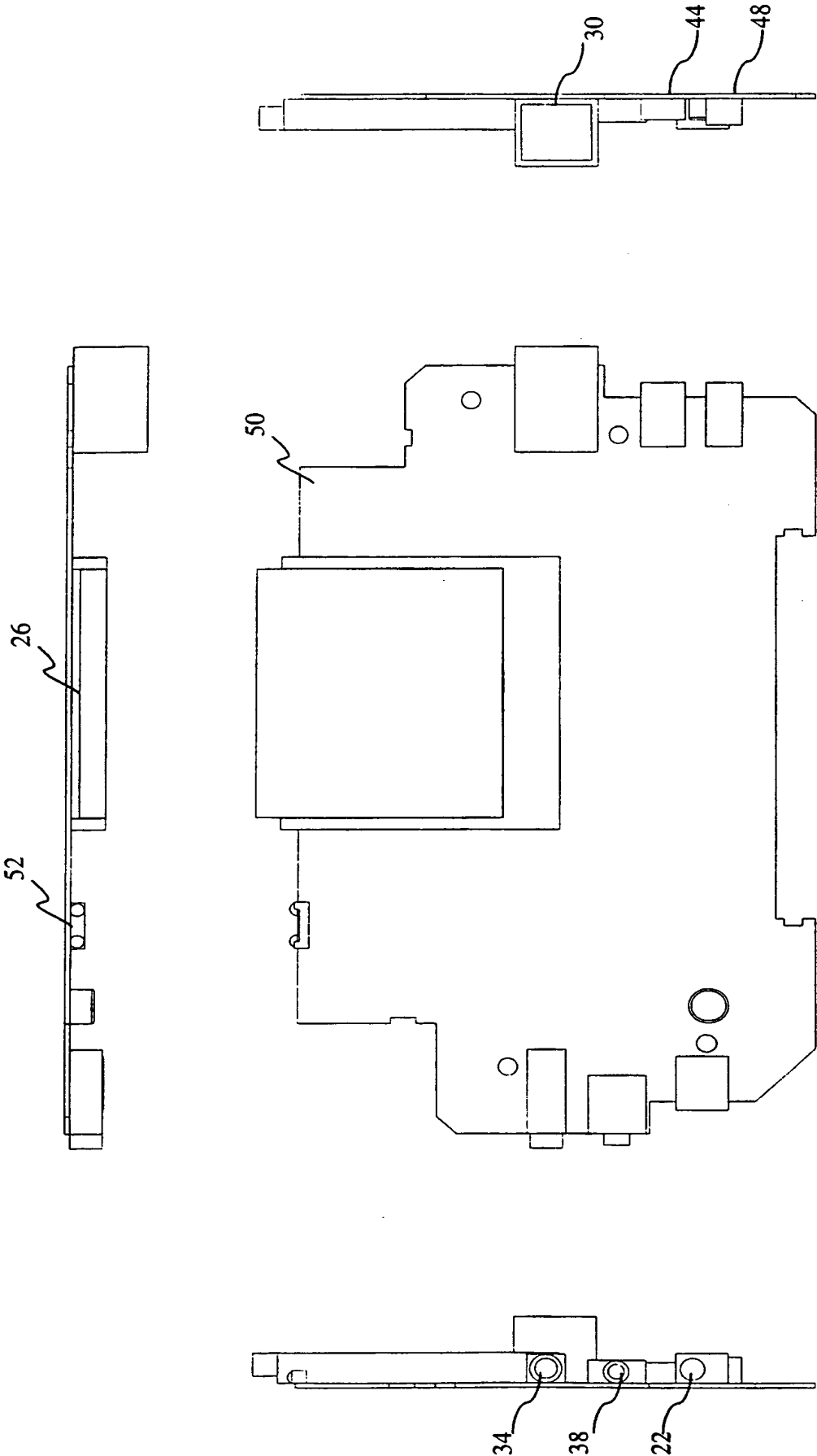
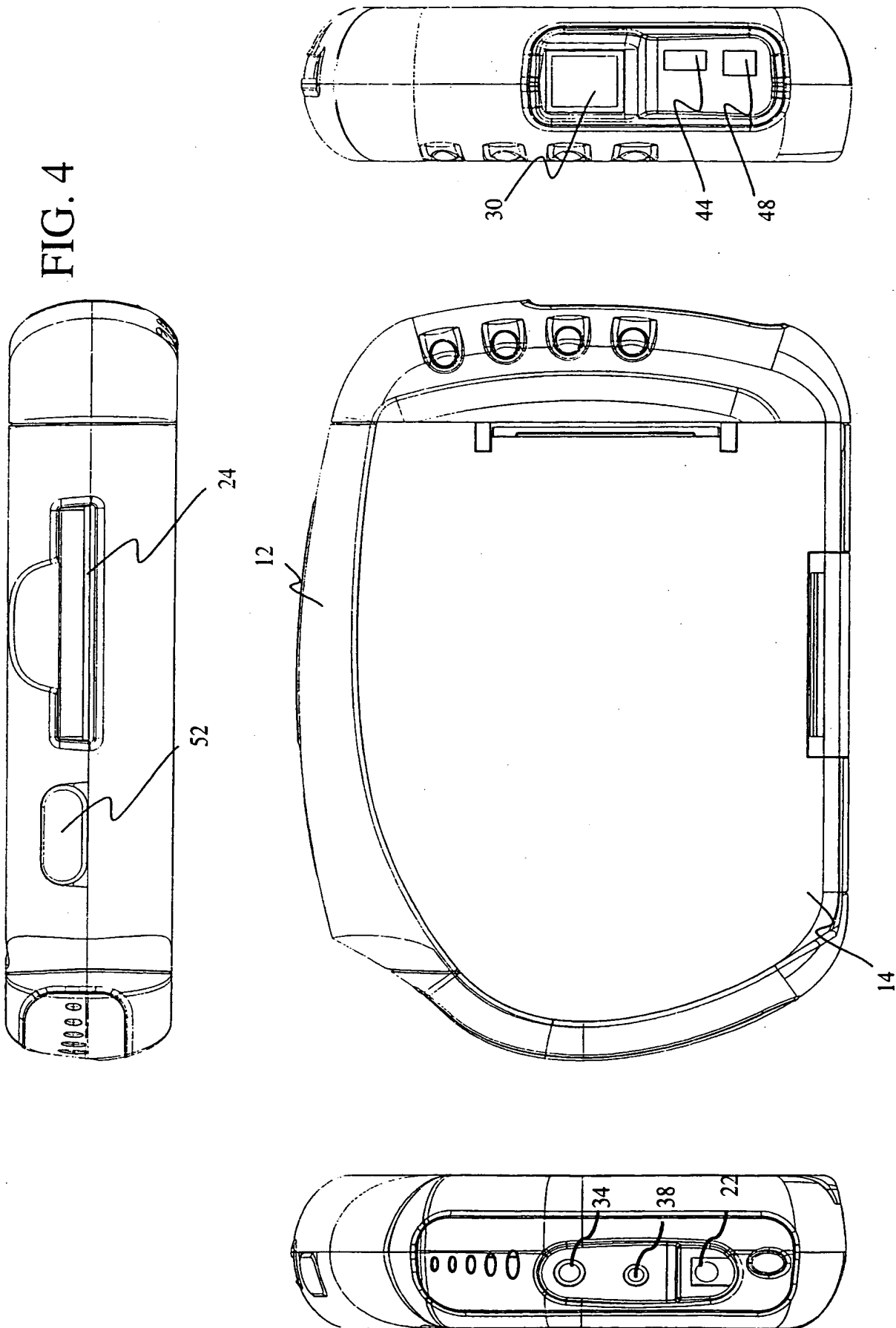
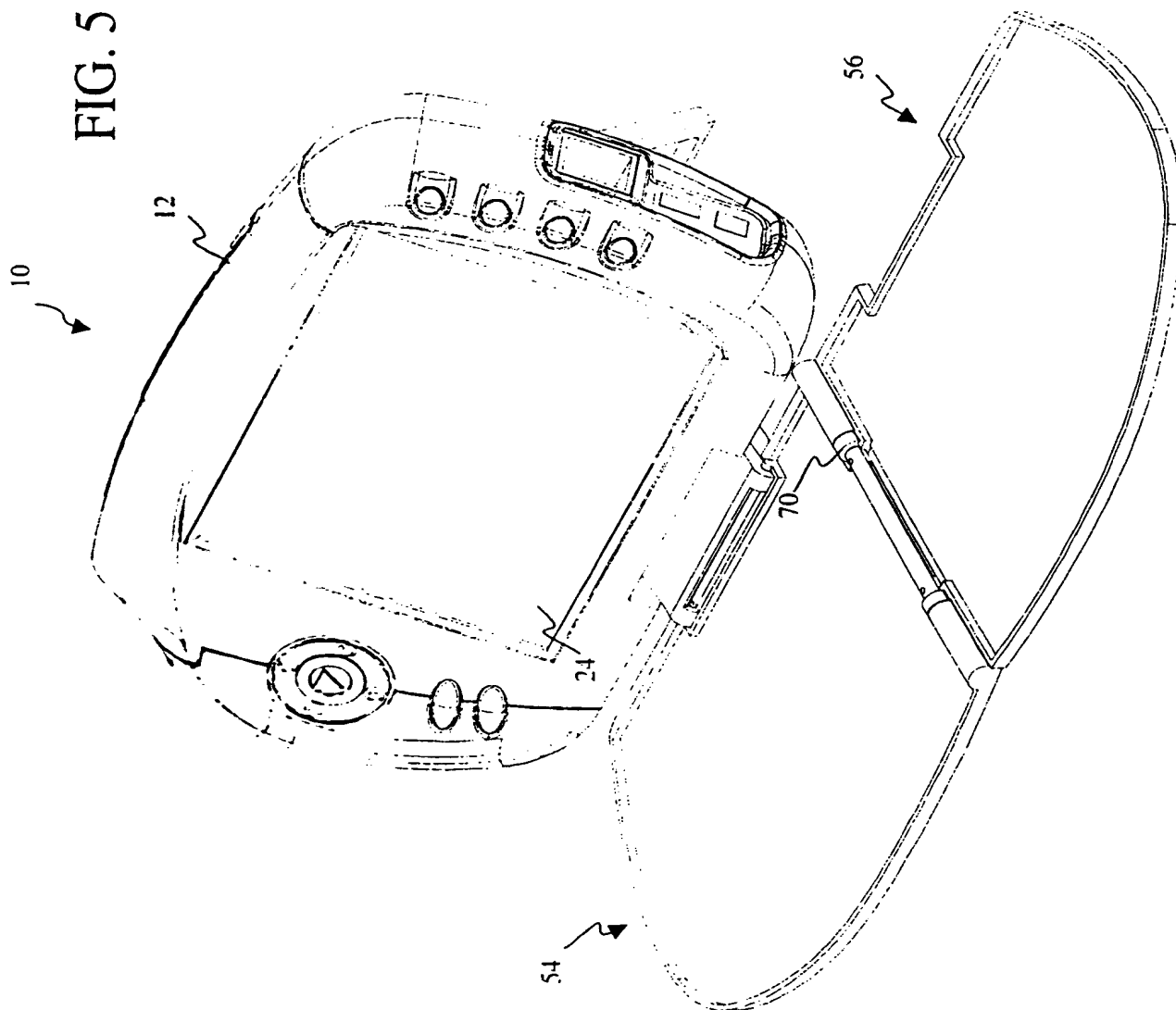


FIG. 4

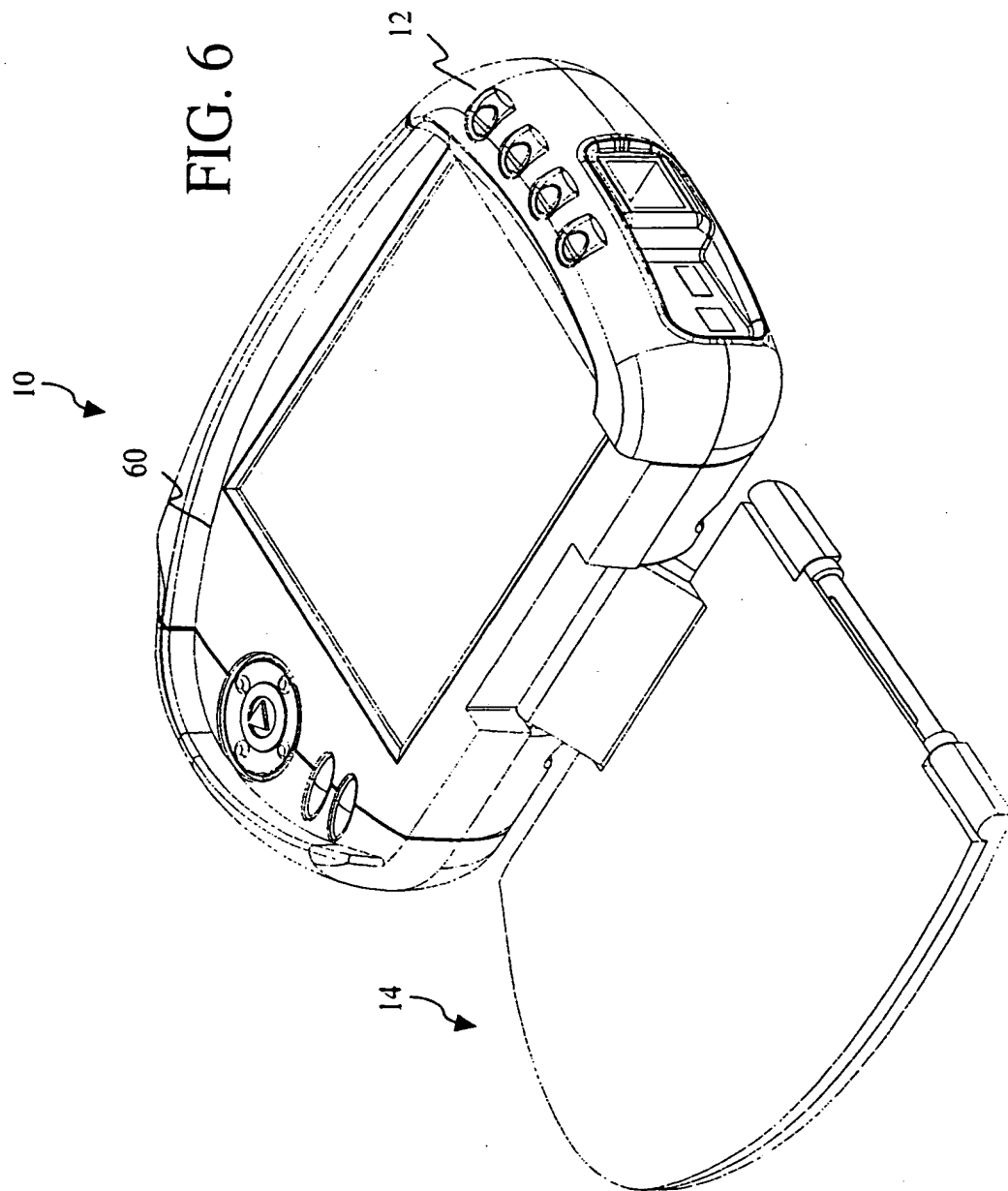


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FIG. 5

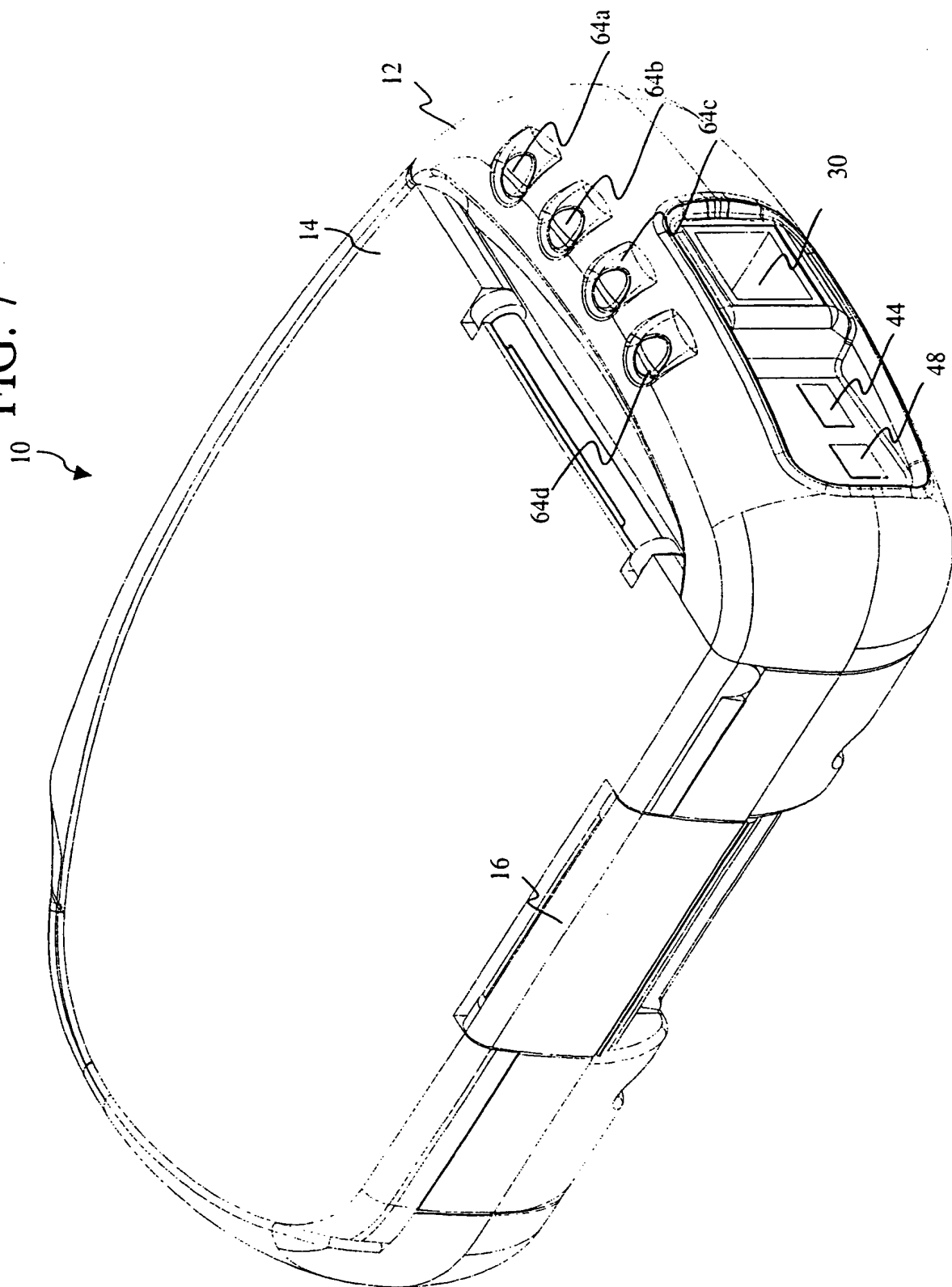






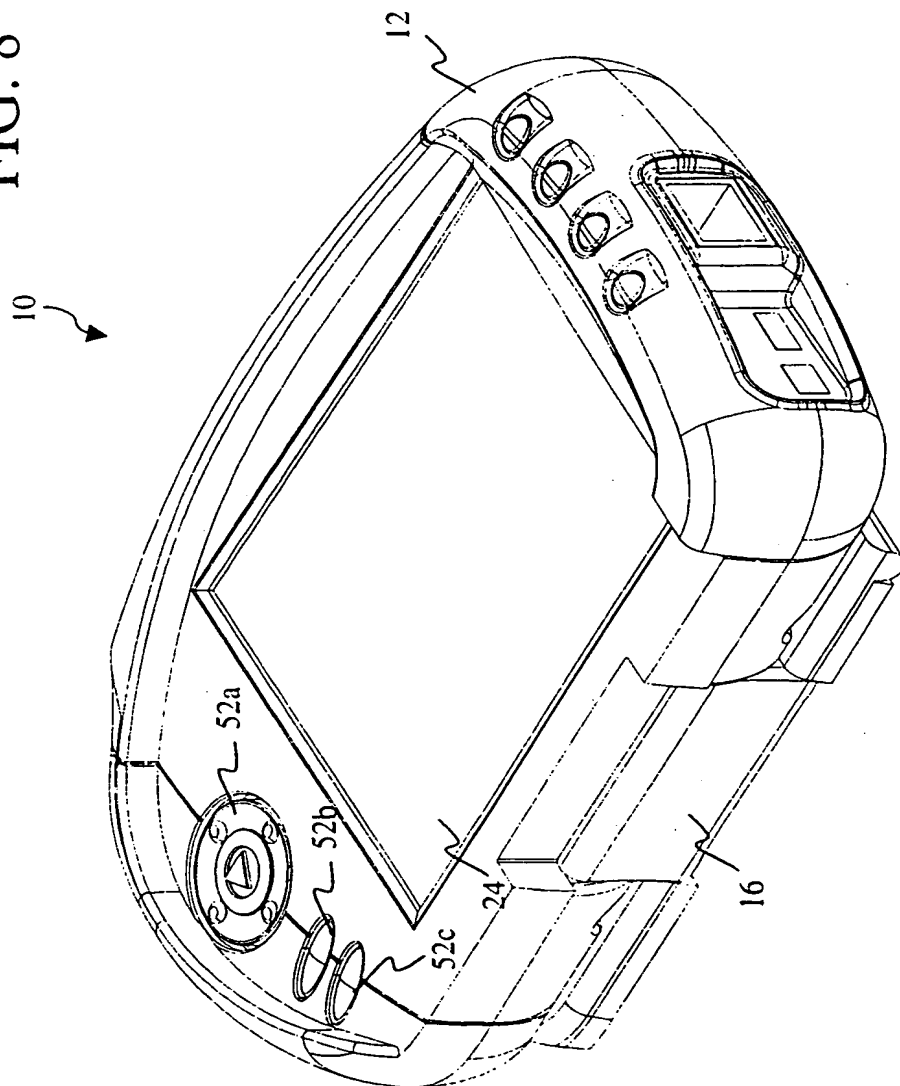
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FIG. 7



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FIG. 8



**SUBSTITUTE SHEET (RULE 26)**

FIG. 9

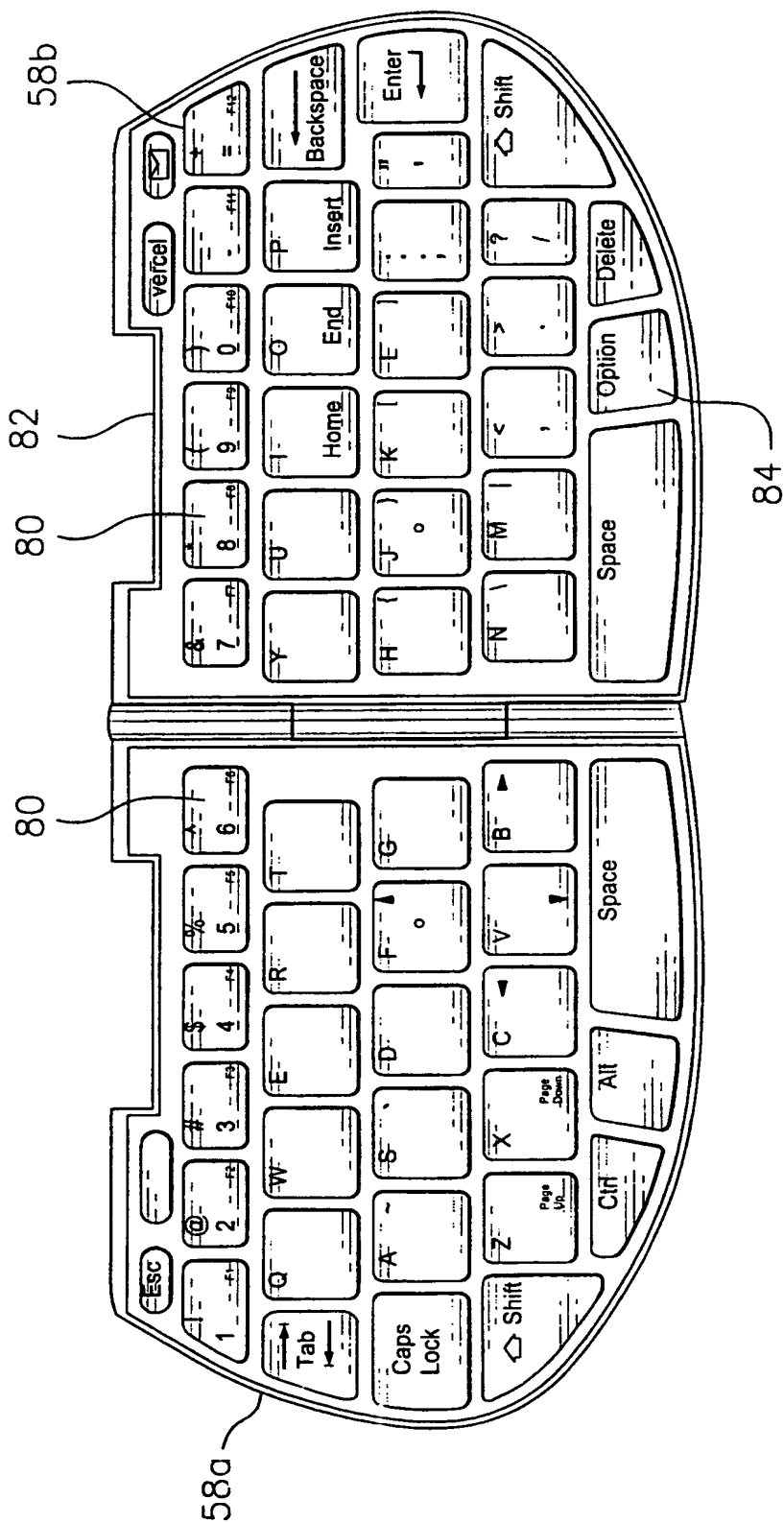


FIG. 10A

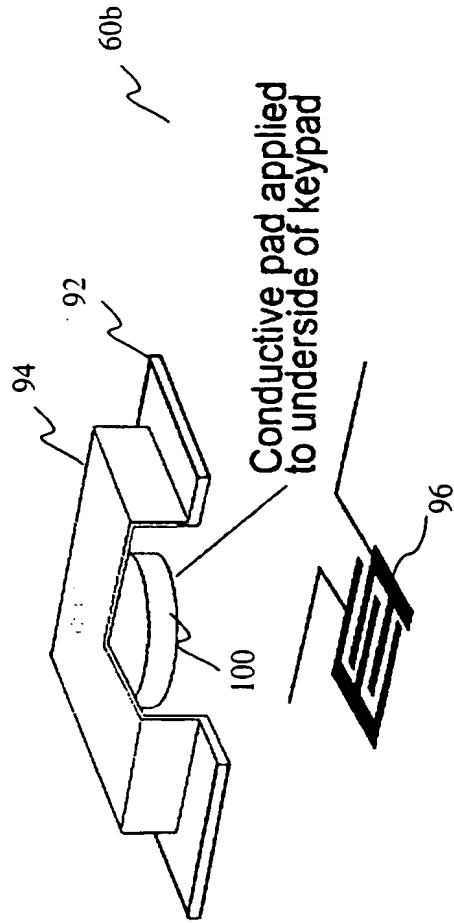


FIG. 10B

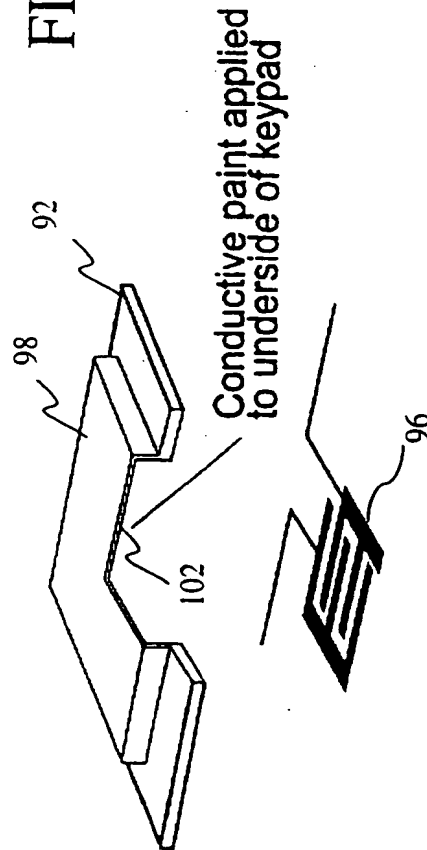


FIG. 10C

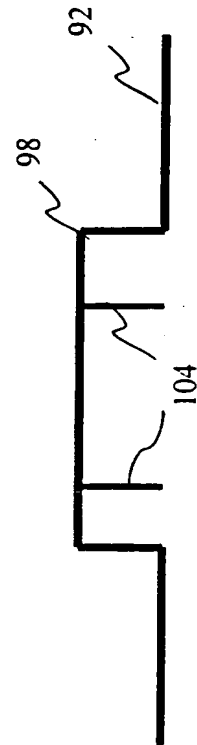
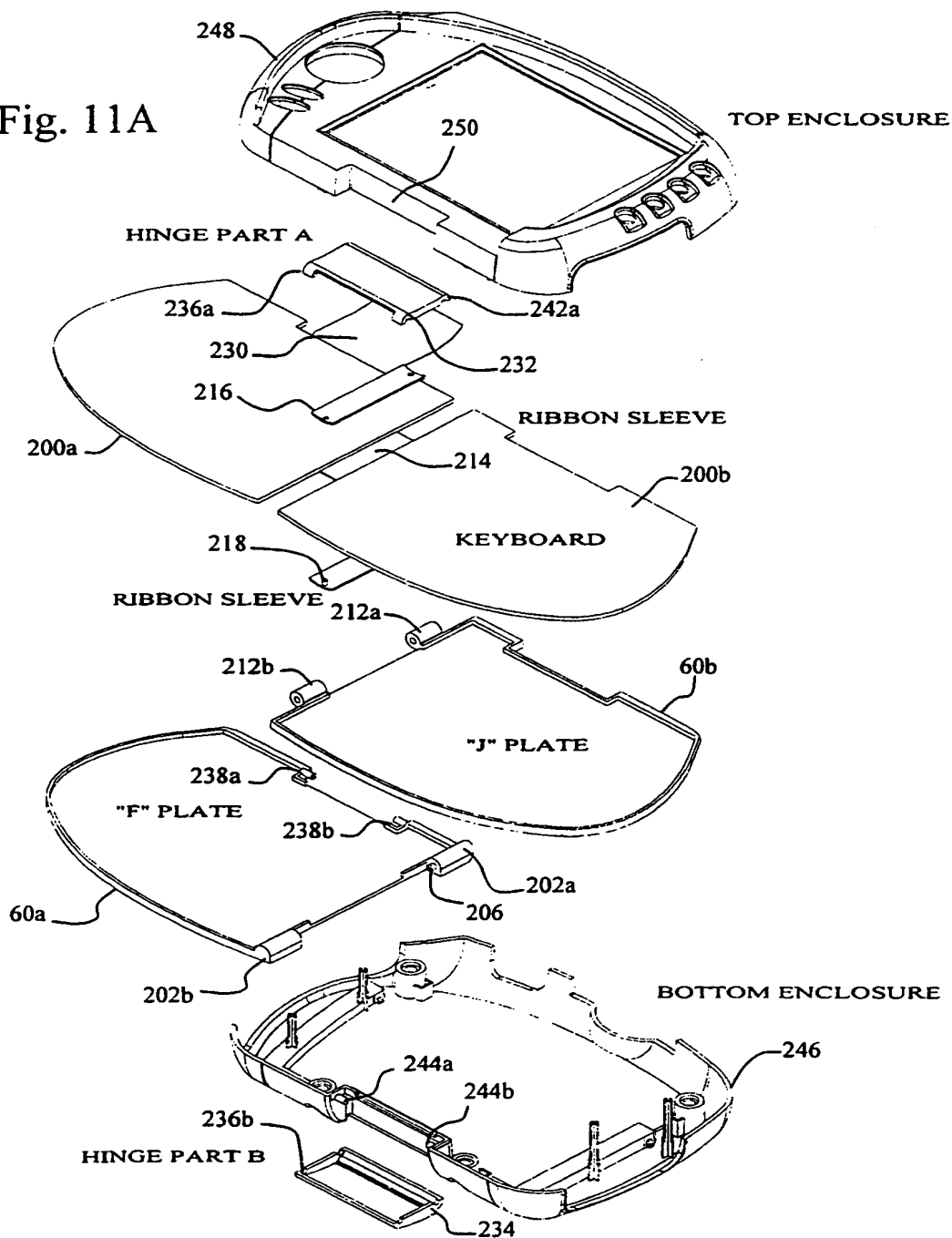
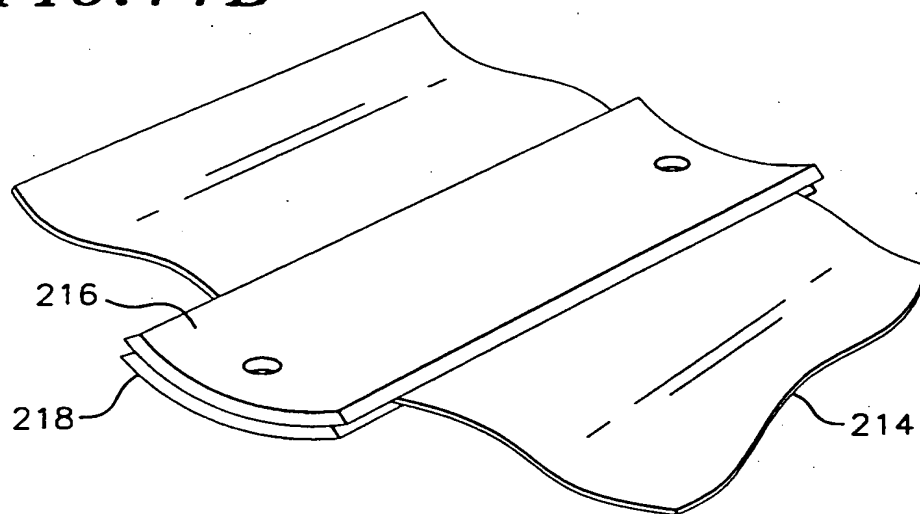


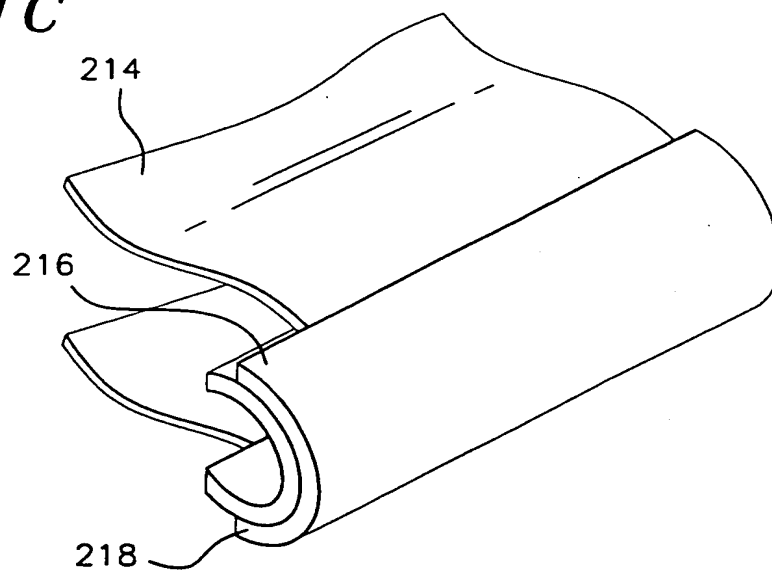
Fig. 11A

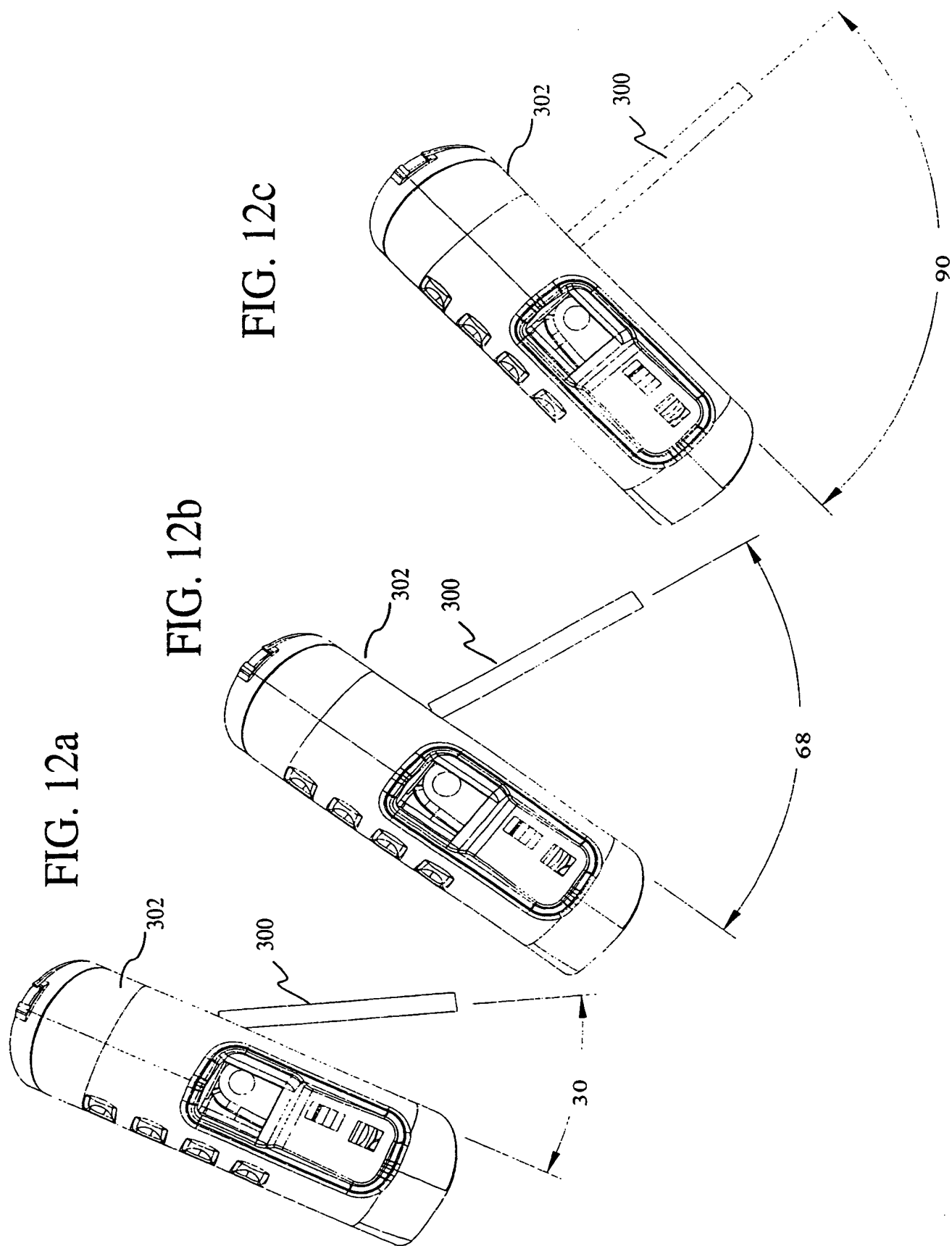


**FIG. 11B**



**FIG. 11C**





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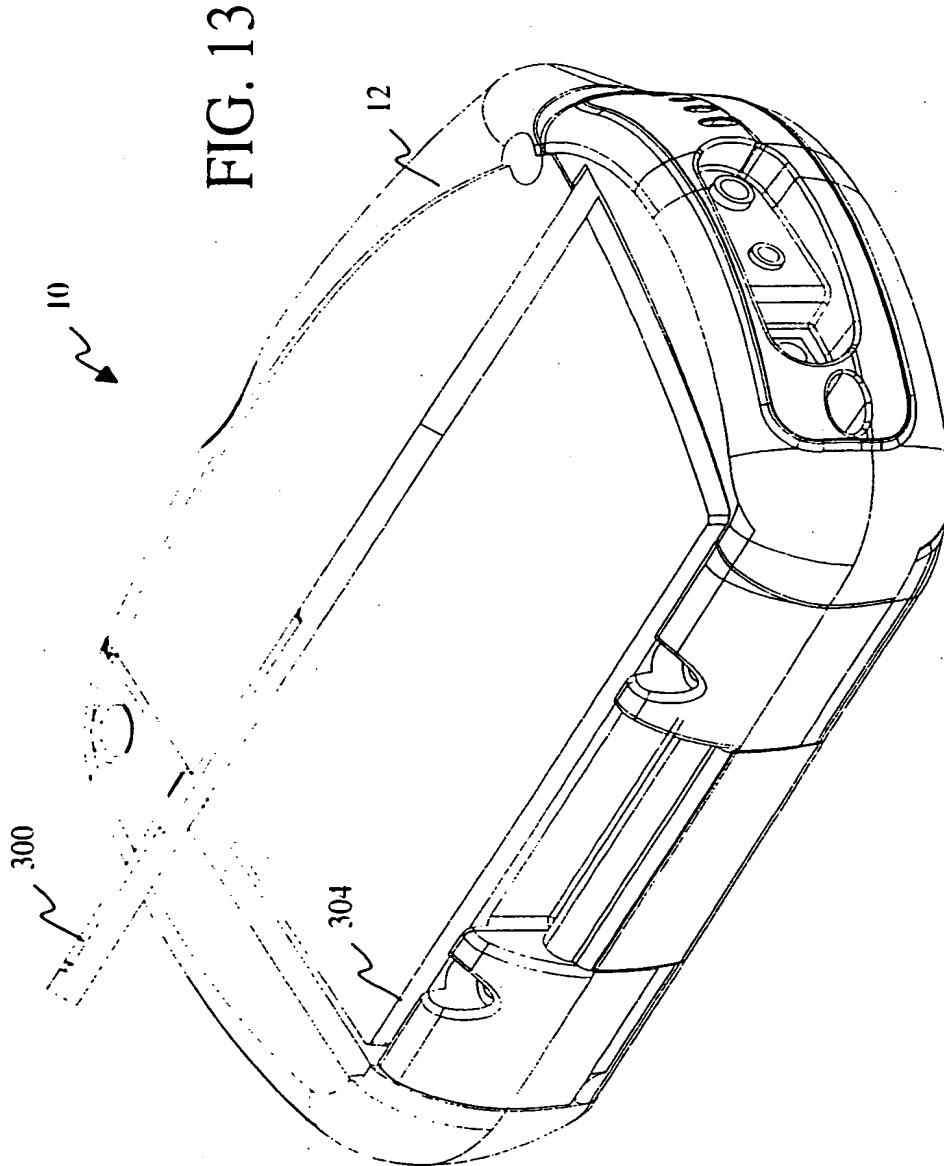
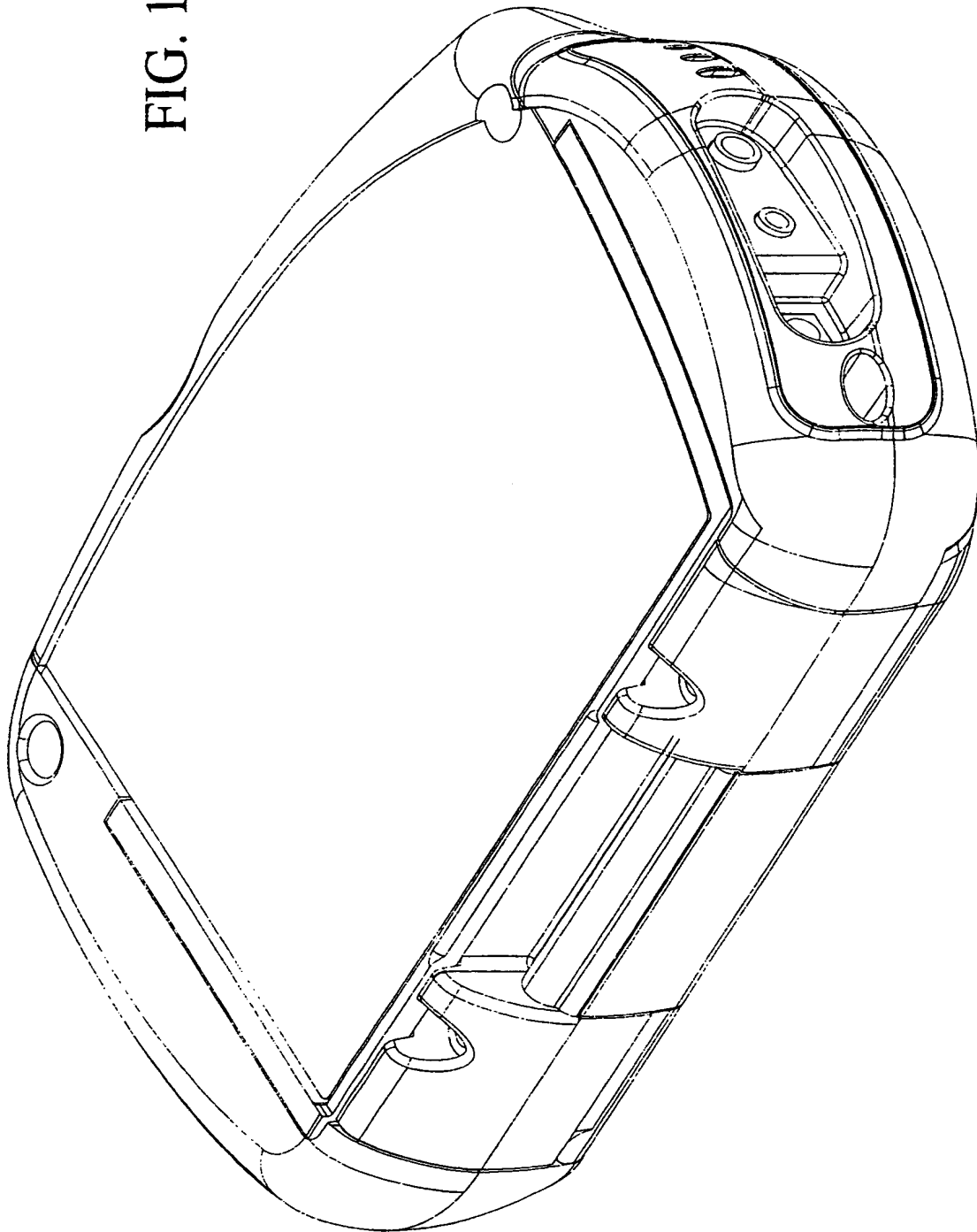


FIG. 14



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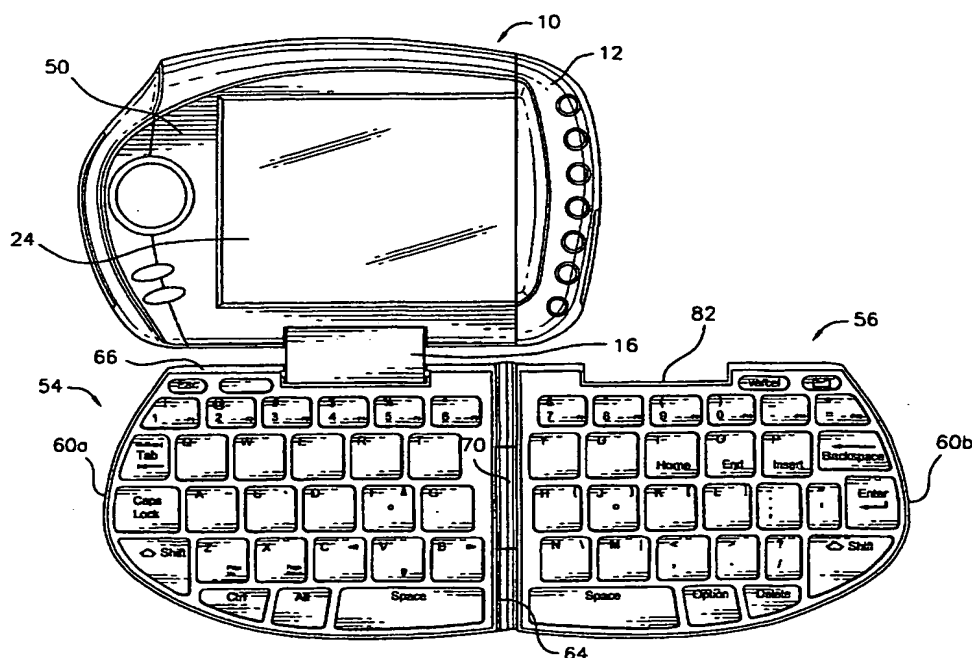
(74) Agent: **LAMPERT, Gregory, S.**; Christie, Parker & Hale,  
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DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,  
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,  
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patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
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CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: **HAND HELD INTERNET BROWSER WITH FOLDING KEYBOARD**



(57) Abstract: The present invention provides an improved hand held computer arrangement (10) wherein data input is facilitated through a full function, folding keyboard (14), that is suitable for touch typing. In addition, the present invention utilizes an open architecture, embedded technology system design in conjunction with web based content to provide a full function affordable portal to the Internet.

WO 01/40914 A3



**Published:**

— with international search report

**(88) Date of publication of the international search report:**

7 March 2002

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/US 00/32647

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 G06F1/16 H01H13/70

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1995, no. 03, 28 April 1995 (1995-04-28) & JP 06 337733 A (MUTSUOKO KAWASAKI), 6 December 1994 (1994-12-06)	1-3
Y	abstract	24, 25
Y	"COMPACT PERSONAL COMPUTER MEMORY CARD INTERFACE ASSOCIATION KEYPAD FOR TABLET PERSONAL COMPUTER" IBM TECHNICAL DISCLOSURE BULLETIN, US, IBM CORP. NEW YORK, vol. 40, no. 2, 1 February 1997 (1997-02-01), pages 59-60, XP000692169 ISSN: 0018-8689 the whole document	1

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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Date of mailing of the international search report

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Durand, J

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/32647

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 279 617 A (INT COMPUTERS LTD) 11 January 1995 (1995-01-11)	1
A	the whole document	20-22
A	US 5 890 016 A (TSO MICHAEL MAN-HAK) 30 March 1999 (1999-03-30) column 2, line 29 - line 36 column 3, line 54 - line 62 column 4, line 14 - line 17 column 5, line 42 - line 45; figures 1-3	2-4, 12, 20
A	WO 99 35557 A (MICROSOFT CORP) 15 July 1999 (1999-07-15) page 10, line 15 - page 11, line 20; figures 2-4	2, 3, 20-22
Y	EP 0 837 406 A (SYMBOL TECHNOLOGIES INC) 22 April 1998 (1998-04-22) page 4, line 23 - line 30 page 16, line 38 - line 49 page 34, line 14 - line 36 page 40, line 17 - line 34; figures 9, 33	24, 25
A		2-6
A	US 5 964 847 A (BOOTH III EARL HARDIN ET AL) 12 October 1999 (1999-10-12) column 6, line 14 - line 67 column 9, line 28 - line 36; figure 6	2-7, 10, 23-27, 30
A	"TERMINPLANER" CHIP ZEITSCHRIFT FUER MIKROCOMPUTER-TECHNIK, VOGEL VERLAG. WURZBURG, DE, no. 9, September 1999 (1999-09), pages 119-126, 128-129, XP000878206 ISSN: 0170-6632 Description Casio Cassiopeia E 105G page 125	6-8, 25, 26
X	US 5 481 263 A (CHOI MAN S) 2 January 1996 (1996-01-02) column 3, line 52 - column 4, line 8; figure 1	1-3, 13, 15
A		14, 24, 31-33
A	EP 0 886 222 A (FIMOR SA) 23 December 1998 (1998-12-23) column 14, line 46 - line 52 column 15, line 16 - line 44; figure 8	13-15, 31-33
A	US 5 581 440 A (TOEDTER PETER K) 3 December 1996 (1996-12-03) column 2, line 49 - line 56; figures 1, 3, 4	14, 32, 33
	-/--	

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/32647

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 653 543 A (ABE NOBUYUKI) 5 August 1997 (1997-08-05) column 7, line 36 - column 8, line 16; figures 15-18 -----	13,14, 31-33
A	US 5 712 760 A (COULON ET AL) 27 January 1998 (1998-01-27) column 4, line 17 - line 24 column 4, line 39 - line 42 column 5, line 18 - line 25; figures -----	1,13,15, 24,31
A	EP 0 461 529 A (FUJITSU LTD) 18 December 1991 (1991-12-18) column 1, line 32 - line 40 column 5, line 24 - line 34; figures 1,2,4 -----	16-19
A	US 5 812 116 A (MALHI SATWINDER D S) 22 September 1998 (1998-09-22) column 4, line 41 - line 57; figure 5 -----	16-18

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 00/32647

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:  
1-22, 24-29, 31-33
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.



**FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-4, 12, 20-22

1.1. Claims: 1-4

hand held computer with foldable keyboard, embedded processor and real time operating system

1.2. Claim : 12

hand held computer with USB connector

1.3. Claim : 20

hand held computer with touch screen

1.4. Claim : 21 22

hand held computer with display controls

2. Claims: 5, 24-33

hand held computer with thin internet browser

3. Claims: 6-11

hand held computer with compact flash interface

4. Claims: 13-15

details of connections between sections of a foldable keyboard and a computer processing unit

5. Claims: 16-19

constructional details of keys of a foldable keyboard

6. Claim : 23

hand held computer with internal modem and telephone line connector

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 00/32647

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